

# UDRC: spearheading defence signal processing

The last decade has seen a revolution in advanced sensor technology and adaptive processing, with a broad impact on many defence applications. Exploring these applications is the University Defence Research Collaboration, a partnership that specialises in signal processing. MOD Defence Contracts Bulletin features writer Julie Shennan caught up with UDRC Project Manager Janet Forbes at the University of Edinburgh, who coordinates the collaboration, to find out more.

**T**he University Defence Research Collaboration (UDRC) develops research in signal processing with application to defence. It is an academia-led collaboration which includes strong partnerships with defence industries.

Work within this collaboration has been split into two phases of research. UDRC commenced its second phase of work in 2013, an ambitious five-year project focusing on 'Signal Processing in a Networked Battlespace', attracting an £8 million research grant.

This research programme is jointly led and coordinated by two academic consortia across the UK: the Edinburgh Consortium – comprising the University of Edinburgh and Heriot-Watt University; and the LSSC Consortium – comprising Loughborough University, the University of Surrey, the University of Strathclyde and Cardiff University.

This work is funded by the Ministry of Defence and the Engineering and Physical Sciences Research Council (EPSRC).

UDRC Project Manager Janet Forbes is coordinating the research work within the Edinburgh Consortium. She said: "The universities were chosen for their commercial sector connections and specialist academics. From the six universities, UDRC has 38

researchers and 14 PhD students. Each Consortium also has a Strategic Advisory Group made up of industry partners and independent experts. This group ensures that the research continues to target applications key to national and international defence."

Sensors have for a long time played a vital role in our Armed Forces, from imaging technologies, radar and sonar to acoustic and electronic surveillance. Sensors are the eyes and ears of the military, providing tactical information and assisting in the identification and assessment of threats. Integral in achieving these goals is signal processing.

Janet Forbes explained: "Modern signal processing algorithms can enhance the performance of sensors, transforming them into highly sophisticated sensing systems capable beyond their original operating specifications. Improvements can be made in imaging resolution, target detection and classification, and the discrimination of multiple moving targets."

"Researchers are creating software which has the ability to assimilate signals from many sources over a wide area, enabling operatives to understand their environment and to respond rapidly when necessary."

"These technologies are being developed within the UDRC for land, sea, air and space

applications. This development presents many challenges, such as selecting the appropriate signal amid the range of other signals and background noise inherent in the sampling environment."

Tackling these challenges are UDRC's 11 work packages, divided between the Edinburgh and LSSC consortia.

The Edinburgh Consortium is responsible for work on six packages: Sparse Representations and Compressed Sensing; Distributed Multi Sensor Processing; Unified Detection Localization and Classification (DLC) in Complex Environments; Context-driven Behaviour Monitoring and Anomaly Detection; Network Enabled Sensor Management; and Efficient Computation of Complex Signal Processing Algorithms.

The LSSC Consortium is conducting research on the remaining five packages: Automated Statistical Anomaly Detection and Classification in High Dimensions for the Networked Battlespace; Handling Uncertainty and Incorporating Domain Knowledge; Signal Separation and Broadband Distributed Beamforming; Multiple Input Multiple Output (MIMO) and Distributed Sensing; and Low Complexity Algorithms and Efficient Implementation.

This research uses state-of-the-art hardware, for example bespoke sensors, autonomous systems such as drones, underwater vehicles, smart phones, radar/wireless systems, sensor networks and digital cameras.

Janet Forbes said: "UDRC has made significant breakthroughs in the areas of low frequency synthetic aperture radar

imaging, multi-target tracking algorithms, anomaly detection for cyber security and micro Doppler technologies for target detection."

The programme also utilises its links with defence experts, as Janet Forbes explained: "The Defence Science and Technology Laboratory (Dstl) works closely

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– Janet Forbes, Project Manager, University of Edinburgh

with the research community on all levels and a programme of events has been developed. This programme hosts 'themed' meetings, which are lively, technical discussions involving industrial specialists, Dstl scientists and academic researchers.

"As well as these meetings, the UDRC holds an annual Summer School on Signal Processing for Defence. This school is taught at Masters Level, is free to attend and open to all who have an interest in signal processing."

The 2015 Summer School will cover Statistical Signal Processing; Tracking, Pattern Recognition and Classification; and Source Separation. The Summer School is currently open for applications with a closing date of 30 March.

Also on the horizon is the international conference on Sensor Signal Processing

for Defence (SSPD 2015), which will be hosted on 9-10 September at the Royal College of Physicians of Edinburgh.

Janet Forbes concluded: "SSPD 2015 is sponsored by the IEEE Signal Processing Society and is a fantastic opportunity to hear about cutting-edge developments in this field for defence."

"The sessions are varied and can range from special interest sessions such as target recognition, electronic surveillance and synthetic aperture radar to keynote speakers from defence and academia."

"There are also innovative and popular industry and military sessions where specialists from those sectors talk about the specific challenges they face in implementing and using signal processing techniques. I have not seen these sessions before at other signal processing conferences and they always prompt lots of animated discussion."

## Further Information

For more information, visit: [www.mod-udrc.org](http://www.mod-udrc.org)



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